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ABSTRACT

A study investigated the proposition that males have a predominant tendency to encode visually when reading, whereas females tend to encode phonologically. Arabic symbols were used to teach a group of 24 college students to "read." Subjects were assigned randomly to one of two conditions: learning the symbols as "letters" one by one with the aid of a tape, or learning the symbols in groups as "whole words," again with the aid of a tape. They were then asked to transfer the knowledge to "new" words containing the same elements. The findings indicated that males appeared to benefit more from word training whereas females benefited more from letter training in the transfer task. The findings suggest that when teaching reading to young children, a more visually oriented method might be more effective with boys and a less visual method might be more effective for girls. (HTH)

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Sex Differences in Visual encoding skills: learning to read.

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The transformation of symbols into sounds is part of the reading process, certainly in the initial stages of reading, and perhaps at all stages of reading development. The alphabet is a set of symbols to which sounds have been attached somewhat arbitrarily - and this becomes clearer if we think of the different sounds associated with the same letters by different language groups, or even the same sounds attached to different letters by our own language groups (GHOTI was George Bernard Shaw's way of writing FISH). Meanings are also attached somewhat arbitrarily to letters and groups of letters. So the reader learns to associate symbols with sounds and meanings.

There is some controversy here. It is by no means universally agreed that at all stages of reading development we do in fact phonologically encode individually the visual symbols we see on the page. It has been suggested that the skilled reader can have direct access to the meaning of a word or phrase from the total visual representation without sounding it out or even in to himself. Our concern is not with this debate but in this paper the position is taken that reading is an information-processing activity with component elements one of which is phonological encoding, at least in the early stages of learning to read.

Our concern here is with the size of the unit that is processed, and the variables which decide the strategies adopted, including the size of unit processed in dealing with new words not met previously. The two main approaches to reading instruction in common use stress the employment of different strategies: the whole-word or Look-Say

method is based on the understanding that reading is essentially a visual process, and that visual discrimination and memory are important for the development of reading skill. With this method the child is confronted with a whole word (the Look) and must associate a response to it (the Say). The child must by himself search for correspondence between the messages in writing and in script. On the other hand, the phonic method of reading instruction focusses the attention of the child on small units of speech and of script. The child is required to pair letters with spoken sounds and then to blend the sounds to make a word. There are advantages and disadvantages to each approach and there is little agreement on whether either is superior or should take precedence over the other in a combination approach. Much may depend on which components of reading skill a given child finds it easier to learn at a given stage in his or her development. But perhaps the respective success of the whole-word and phonic methods, at least as measured by their effectiveness in promoting transfer to new material is more predictable than has been suggested. Perhaps the sex of the individual is an important variable. This is the issue investigated in the present study.

While females have been found to excel in a number of verbal and linguistic functions, it has been established that males seem to be superior in the perception and use of visuo-spatial relationships. The application of this to reading was investigated by Coltheart et al (1975). They hypothesised that females would notice fewer unpronounced letters than would males in a letter cancellation task, since verbal analysis will not detect such letters (h in this instance). The results showed that for pronounced targets, there was a negligible difference between male and female miss rates; for unpronounced

targets, females overlooked significantly more targets than males. This was interpreted as indicating a greater prevalence of phonological encoding during reading in females. In a further experiment, Coltheart et al (1975) used a lexical decision task in which the subjects were required to identify a string of letters as an English word or not, (using a Yes or No button). The hypothesis was that females, if using phonological access, would be slower to recognise homophonic unreal words than would males who presumably used direct visual access. This hypothesis was supported. Support for this position came also from a recent study by Naish (1980). Naish observed that perhaps for individual subjects one form of analysis, be it visual or phonological, is faster than the other and is therefore almost always used to access the word's meaning. Using the Stroop effect, he found that for female subjects, phonological encoding did seem to be responsible for the effect, and thus the faster of the two access routes. The result lends support to the suggestion that for females, in this particular task at least, the preferred mode of access was via the phonological route, and that the preferred mode of access for males was via the visual route.

The question investigated in the present study follows from these findings: if, as suggested, there is a basic tendency on the part of females to use a phonological route and on the part of males to use a visual route of access when reading, would it prove more efficient to teach girls to read by a phonological method (phonics) and boys by a visual method (whole-word)?

Hypothesis

Females would benefit more from reading instruction by the use of individual letters, while males would benefit more from the use of whole words.

Subjects

There were 24 subjects, 12 male, 12 female; University undergraduates from a variety of disciplines. They were allocated randomly to the two instruction conditions. There were equal numbers of subjects in each condition and equal numbers of males and females within each condition. C.A. 19-24.

Materials and Method

The methodology was based on that of Bishop (1964) with some modifications which were considered to be improvements. The materials consisted of 12 Arabic letters, each with a 1/1 grapheme correspondence, printed individually on white cards. There were also 8 Arabic transfer words, each 4 letters in length, printed individually on white cards. The set of 12 letters represented 8 consonant and 4 vowel sounds and they were combined to form the transfer and the training words. The word sets were constructed so that each consonant letter appeared twice in the transfer set and each vowel-letter four times in each set. The words were all of the CVCV pattern and were easily pronounceable. Half of the 8 consonants appeared as the initial letters in the set of training words and the other half appeared twice each as the initial letters in the set of transfer words.

The 12 letter sounds were recorded on cassette tape in 4 different orders. A 4-sec. interval was left between each letter sound or word and there was an interval of 20 secs. between the various orders.

A few additional features about the letters and words should be noted:

i) The words were not real Arabic words;

ii) The same letter represented a particular sound regardless of its position;

iii) The letters were not joined;

iv) The words were written from left to right - the reverse is the case for real Arabic, but it was thought that this would present problems of interference from previous habits for English speakers.

Procedure

1. Each subject listened to the set of transfer words on tape. The eight words were presented in four different orders and the subjects was required to repeat each word in the four-second interval before the next word.

2. (Letter Group). Subjects listened to the set of 12 letter sounds, repeating each sound. The set was heard twice in different orders. Then the subject was trained to associate the appropriate graphic symbol with the sound by exposure of a card as each sound was heard; the subjects were instructed to try to learn the associations. In 16 subsequent trials, the experimenter presented appropriate cards and the subject had to try to insert the correct sound before the next sound was presented on tape. The tape then acted as corrective feedback.

The numbers of trials to mastery was recorded and also the numbers of errors made on the 16th trial by those who still had not mastered the task.

3. (Word Group) These subjects followed the same procedure but had to associate whole words with their sounds. Twenty four trials were given for learning and as above, E recorded the number of trials needed for mastery and the number of errors on the 24th trial. The difference in training times meant in fact equalisation as the amount to be learnt differed.

4. All subjects were tested on their ability to learn the set of transfer words which were novel to sight if not to sound. Cards were presented and subjects responded in the same way as for stage 2, but they were instructed to try to read the words from the very first trial if possible and to provide the response before the tape did. These transfer trials continued until a criterion of two consecutive perfect trials had been achieved. E recorded the number of responses made on the initial transfer trial and the number of trials needed to reach criterion.

Results:

1. Extent of learning the training task

a) Letter-trained group; five of the six female subjects mastered the task within the 16 trials - ie, they were able to name all letter sounds within a single trial. Four of the six male subjects mastered the task within the time allowed. Statistically these could not be compared but undoubtedly there is a trend and it is clear from this table showing the average % overlearning that occurred.

INSERT TABLE 1 ABOUT HERE

Within the word-trained group, five from each subgroup mastered the task within the allowed time. When the means were compared, results indicated that the means for females were greater than for males. This was not significant at the 5% level, but was at the 10% level and so could be seen as indicating a trend.

INSERT TABLE II ABOUT HERE

There are two interesting points to be made here. The first is that the male groups seemed to perform better under both conditions than did the female groups, and the second is that for females there was quite a big difference between the success rates for those being taught by the letter method and those being taught by the word method in favour of the former, suggesting support for the hypothesis that the phonological route may be the preferred one for females. For males the picture was not so clear on this criterion. They seemed to do equally well on both according to the criterion of the first correct trial after learning.

The second criterion for mastery was measurement of transfer. This was assessed by the number of correct responses on the first transfer trial - ie the number of words from the transfer list that the subject guessed correctly when he saw them for the first time after completing the learning trials. Many subjects failed to make any correct responses on the first transfer trial. But all the letter-trained females were able to make at least one correct response on this trial compared to only one word-trained female. This would suggest superiority of the letter trained condition. Three males from each training condition managed to make at least one correct response on

the first transfer trial. On average however, more correct responses were made by word trained males than by letter trained males.

INSERT TABLE III ABOUT HERE

This table does not present the whole picture however. Only three of the letter-trained males made a correct response, while all six of the females did so; in addition one male read six of the eight words correctly on the first trial (word-training condition) and this obviously influenced the group mean.

Again here, the main point is that it would seem that letter trained females perform better than word-trained females on transfer to new words. The picture is less clear for males as regards this particular criterion. The third criterion for effectiveness of training was the number of trials taken to reach perfection with the transfer words.

INSERT TABLE IV ABOUT HERE

A two-way ANOVA was performed on these data with two between factors (sex and training condition), each with the two levels (male, female; letter, word). The results showed that at the 5% level, the F value closely approached significance when the interaction between sex and type of training in determining the number of trials to perfection was examined. If such a tendency exists there is support for the hypothesis that there are sex differences in the transfer effectiveness of word and letter training in reading. On average, letter-trained females reached perfection in only 13 trials as opposed to 19.5 trials for word-trained females. Two letter-trained females reached perfection very quickly (5 and 3 trials) while none of the

word-trained females achieved this is fewer than 10 trials. The slowest letter-trained females took 21 trials whereas the slowest word-trained females took 26 and 34 trials.

With males the discrepancy between the two training conditions was even more striking. Word-trained males took only 7.8 trials to reach perfection on average, whereas letter-trained males took 20 trials to do so. It looks as if a greater number of subjects might have brought the effect of an interaction between sex and training on this criterion to significance.

Relevance of Results

In practical terms, the most important result obtained was that there may be differential effectiveness of method of reading instruction according to sex. Certainly females found letter-training simpler than word training and the reverse was the case for males as indicated by the degree of overlearning in the transfer task. Furthermore it is clear that for females phonic training rather than whole-word training led to greater ease of transfer to new material as measured by the two transfer criteria. Although the picture for males was somewhat unclear, by one of the criteria it was apparent that whole-word training had been more beneficial than phonic training.

The results did not support previous research reported in the literature by Bishop (1964) that letter-training would be superior to word-training in the transfer task. When sex was discounted in the present study, there was little difference in the transfer effectiveness of word and letter training. This could have been due to a number of factors - the organisation of the learning material which was carefully controlled; the absence of syntactic and semantic

markers which meant reliance solely on featural information; and the fact that the correspondences between letters and sounds were much more straightforward than in normal English text.

The results are also limited by size, background and age of the sample. An extension of the study to children of an appropriate age and stage would be necessary before any definitive stagement could be made about the relative merits of either form of teaching for either sex but it looks as if such a study would merit attention.

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TABLE I

% Average Overlearning

	Letter Group	Word Group
Females	50.94	36.36
Males	56.01	114.28
All subjects	53.48	66.60

TABLE II

Mean Number of Trials to Reach Criterion (No. of first correct trial)

	Letter Group	Word Group
Females	10.6	17.6
Males	10.25	11.2

TABLE III

Mean Number of Correct Responses on First Transfer Trial

	Letter Group	Word Group
Females	1.5	0.33
Males	1.83	2.17

TABLE IV

Mean Number of Trials taken to reach perfection on the Transfer Task

	Letter Group	Word Group
Females	13	19.5
Males	20	7.8